

# Evaluation of Carbon Dioxide Laser in the Treatment of Epidermal Nevi

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## ABSTRACT

**Background:** Epidermal naevi are benign hamartomatous growths of the skin which are generally asymptomatic with a benign course but are cosmetically disagreeable. Topical treatments such as steroids, calcipotriol, 5 fluorouracil, podophyllin, retinoids and cryotherapy are ineffective and surgical excision results in scar formation. Therapy is often challenging. **Aim of the Study:** To study the response of carbon dioxide (CO<sub>2</sub>) laser in the management of epidermal naevi. **Subjects and Methods:** We conducted a study of CO<sub>2</sub> laser treatment on 15 patients of epidermal naevi, eight with verrucous epidermal naevi and seven with sebaceous naevi. A thorough history and examination was done to rule out any epidermal naevus syndrome. The diagnosis was confirmed by histopathology. The number of treatment sessions varied from 1 to 8. **Results:** Response was excellent (>90% reduction in lesion size) in three patients, very good (>75% reduction) in five, good (>50% reduction in lesion size) in five and poor (<50% reduction in lesion size) in two patients. The side effects were hyperpigmentation and scarring. Long-term follow-up over a period of 10 months showed a recurrence rate of 20%. **Conclusion:** We conclude that CO<sub>2</sub> laser treatment might be an effective option with long-term safety, minimal discomfort and rapid recovery.

**KEYWORDS:** Carbon dioxide laser, epidermal naevi, sebaceous naevi

## INTRODUCTION

Epidermal naevi are benign hamartomatous growths of the skin that are present at birth or develop in early childhood. They may be composed of a variety of epidermal cells and structures, including keratinocytes, sebaceous glands, hair follicles, apocrine and eccrine glands and smooth muscle cells and are thought to represent a form of cutaneous mosaicism.<sup>[1,2]</sup>

Keratinocytic epidermal naevi also called linear epidermal naevi or linear verrucous epidermal naevi, are the most common form.<sup>[3]</sup> They present as linear or whorled skin-coloured to brown plaques that tend to follow linear patterns on the skin along the lines of Blaschko.<sup>[4]</sup> Epidermal naevi occur in approximately 1–3/1000 live births; with an equal sex preponderance.<sup>[1,2]</sup> Most epidermal naevi occur sporadically as an isolated

finding, but they also may occur in association with a variety of developmental abnormalities. Epidermal naevi originate from pluripotential germinative cells in the basal layer of the embryonic epidermis. They are thought to represent forms of mosaicism, resulting from post-zygotic mutations in embryonic cells destined to populate a particular area of the epidermis.<sup>[5]</sup> Mutations occurring very early in embryonic development give rise to more extensive epidermal naevi and may potentially affect additional organ systems.<sup>[6,7]</sup>

Sebaceous naevus or naevus sebaceous of Jadassohn is a circumscribed lesion that occurs mainly on the head and neck region and consists predominantly of sebaceous glands, abortive hair follicles and ectopic

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**How to cite this article:** Bhat YJ, Hassan I, Sajad P, Yaseen A, Mubashir S, Akhter S, *et al.* Evaluation of carbon dioxide laser in the treatment of epidermal nevi. *J Cutan Aesthet Surg* 2016;9:183-7.

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10.4103/0974-2077.191646

apocrine glands. The characteristic lesions of sebaceous naevus are slightly raised yellow, orange or light-brown plaques with a smooth or velvety surface. With puberty, the lesions become raised, thickened and nodular. Malignant transformation occurs in 10%–15% of lesions, the most common being basal cell carcinoma and syringocystadenoma papilliferum. In nevus sebaceous, post-zygotic somatic mutations may result in various clinical expressions of mosaicism. Mutations in pluripotential cells may give rise to hamartomas with multiple cell lines. Sebaceous naevi are sporadic and occur with equal frequency in males and females of all races. On histopathology, the epidermis shows papillomatous hyperplasia and an increased number of dermal mature sebaceous glands.<sup>[8]</sup>

Treatment of epidermal and sebaceous naevi is challenging and often the therapeutic outcome is unsatisfactory or cosmetically unacceptable. Carbon dioxide (CO<sub>2</sub>) laser is a very versatile laser which can coagulate, vaporize or excise the tissue; therefore, it has been successfully used to treat many lesions which were considered untreatable.<sup>[9]</sup> Here, we report our experience of treating 15 patients of epidermal and sebaceous naevi with CO<sub>2</sub> laser.

## SUBJECTS AND METHODS

Fifteen patients with epidermal naevi, including eight with verrucous epidermal naevi (five females and three males) and seven with sebaceous naevi (four males and three females) who presented to our outpatient department (OPD), were taken up for this study. The study was approved by Institutional Ethical Committee. In all the patients, a detailed clinical history including the duration of the lesions, evolution, associated symptoms and the previous therapeutic modalities used, were recorded. A thorough clinical examination of the lesions including examination of the old injury scar, *Bacillus Calmette-Guérin* scar, etc., to look for the tendency of keloids/hypertrophic scars was performed. The diagnosis in each patient was made on the basis of clinical features and confirmed by histopathology. A multidisciplinary approach involving neurologic, ophthalmologic, musculoskeletal and visceral organ examination was employed in all patients to rule out epidermal nevus syndrome. The patients with a history of bleeding disorders were excluded from the study.

All the patients wore protective glasses. The lesions were pretreated with diluted savlon and normal saline and anaesthetised with 2% lignocaine, although topical anaesthesia using lignocaine and prilocaine too was used in some patients. The surgical laser system used was the CO<sub>2</sub> laser, model (Derma India V-Care Medical System, Pacific Medical Fulcrum Medical Devices), that

adopts a red coloured helium neon laser beam, set to deliver light at a wavelength of 10,600 nm in normal ultrapulse mode using a spot size of 0.1 mm. Ultra pulse mode provides the advantage of greater control over thermal damage and depth of tissue destruction as compared to the continuous defocused mode. The CO<sub>2</sub> laser penetrates approximately 30 µm into the skin by the absorption and vaporisation of water-containing tissues. Laser power ranged from 8 to 10 W (maximum 35 W) adjusted as per the lesion thickness. Ablation was done in a paintbrush pattern to the level of unaffected dermis until whitish tissue of dermis became visible, which indicated destruction of papillary dermis while the reticular dermis remained unaffected. The latter was done to prevent scar formation. The charred surface after laser ablation was cleaned with betadine or saline. The topical antibiotic cream was used daily in all patients till the laser induced erosions/ulcers healed. One to eight treatment sessions were needed in patients, which were done at an interval of 4 weeks. The patients were evaluated at the end of 2<sup>nd</sup>, 4<sup>th</sup>, 8<sup>th</sup> and 12<sup>th</sup> weeks to assess the response. Post-treatment effects such as colour changes, itching, pain, infection, scarring, atrophy and recurrence if any, were also recorded. If there was no satisfactory improvement after the initial treatment, subsequent exposures were given. The final assessment, which was subjective, was done at the end of 3 months, and the overall response was graded as excellent if it regressed by 90%–100%, very good if it was 75%–89%, good (50%–75%) and poor if the improvement was <50%. The patients were then followed up every month for 10 months to look for any recurrence.

## RESULTS

This was a prospective study carried out in our hospital from January 2014 to January 2015, in which the patients with clinicopathologically diagnosed verrucous epidermal naevi and sebaceous naevi who presented to our OPD were taken up for the study. The present study had 15 patients, seven males and eight females between 8 and 25 years of age. Scalp was the most common site of naevus sebaceous, while as the trunk and upper limbs were the most common site of involvement of verrucous epidermal naevi. All the patients had previously used various topical treatments such as retinoids, calcipotriol and steroids; however, the results were disappointing. The number of treatment sessions varied from 1 to 8, which were spaced at an interval of 4 weeks. In the short-term, response was excellent in three patients (20%) [Figures 1-4], very good in five (33.33%) and good in five (33.33%). Only two patients had a poor response (<50% reduction). One of these patients had systematised epidermal naevus which did not regress fully even after 8 sittings in different zones [Figures 5 and 6]. Six patients received only three



treatment sessions; three patients received four sessions, two patients five, three patients six and only one patient received eight sessions. Immediate side effects included erythema and pain for 1–2 days in 4 (26%) patients.



Figure 1: Sebaceous nevus over right side of forehead in a female

Infection of the lesion was seen only in one patient (0.06%) which subsided after oral amoxicillin-clavulanate combination for 1 week. Hyperpigmentation was seen



Figure 2: Same patient while undergoing the carbon dioxide laser treatment



Figure 3: Hyperpigmentation and transient desquamation at the nevus site



Figure 4: Complete resolution of lesion at 12-week follow-up with hyperpigmentation as a side effect



Figure 5: Systematised epidermal naevus before treatment



Figure 6: Systematised epidermal naevus after four sessions of treatment

in four (26%) patients, hypopigmentation in one (0.06%) and mild atrophic scarring in two (13%) patients after 6 months of follow-up. Recurrence of the lesions was seen in three patients (20%) after 10 months of follow-up, which was observed in the first 4 months in two patients and between 6<sup>th</sup> and 8<sup>th</sup> month in the third patient.

## DISCUSSION

Epidermal naevi are benign hamartomatous skin growths, but they can cause significant problems for patients as they can present at conspicuous sites and be cosmetically unsightly. Sebaceous naevus is a circumscribed hamartomatous lesion predominantly composed of sebaceous glands. Sebaceous naevi and verrucous epidermal naevi are closely related, and many authors regard them as variants. Malignant transformation occurs in 10%–15% of lesions in some series.<sup>[10]</sup>

Although a large variety of treatment modalities have been tried, these naevi continue to be a source of frustration because it is difficult to eliminate them completely without residual scarring. Laser therapy destroys a nevus and leaves minimal residual scarring. Various types of lasers have been used for this purpose with varying degrees of success from last two decades. Argon and pulsed ruby laser therapy have been used to treat the epidermal naevi, with limited success. Ablative lasers applied have included erbium: Yttrium aluminium garnet (YAG) and CO<sub>2</sub> lasers. In series showing excellent cosmetic results of erbium: YAG laser treatments, authors have also reported the absence of recurrence over a follow-up period of 24 months. The patients in these studies had superficial or small lesions, however, thicker (more hyperkeratotic) naevi, on the other hand, may not respond or treatment may cause hypertrophic scars.<sup>[11,12]</sup>

Various therapeutic modalities available for treatment of epidermal and sebaceous naevi are either partially effective, insufficient, cosmetically unacceptable or unapplicable particularly for large lesions. CO<sub>2</sub> laser has been effectively used in many such situations with good results.<sup>[9]</sup>

In this study, 15 patients of epidermal and sebaceous naevi were treated with CO<sub>2</sub> laser. The response was excellent (>90% reduction in lesion size) in three patients, very good (>75% reduction) in five, good (>50% reduction in lesion size) in five and poor (<50% reduction in lesion size) in two patients. The poor response in patients was attributed to the very thick lesions where adequate removal could not be done in one or more sittings, and the patient did not agree for subsequent exposures. We followed our patients for 10 months only,

therefore recurrences on a long-term follow-up and in a larger group of patients needs to be evaluated.

Alonso-Castro *et al.* in a study of the effect of CO<sub>2</sub> laser on epidermal naevi, reported excellent response in more than 30% and good response in >50% patients.<sup>[13]</sup> Ratz *et al.* used a continuous CO<sub>2</sub> laser to treat 15 patients with epidermal naevi, obtaining good results in half the series. In a later series of 43 patients (two with inflammatory linear verrucous epidermal nevus [ILVEN]) CO<sub>2</sub> laser treatments achieved better results than argon laser therapy for highly verrucous or keratotic lesions. The same group successfully used this modality (with power up to 25 W) to treat an extensive epidermal nevus without causing scarring or seeing recurrence over a period of 4 years.<sup>[14]</sup> Thual *et al.* achieved excellent results (86% cured or greatly improved) with CO<sub>2</sub> laser therapy in 21 patients with VEN.<sup>[15]</sup> The rate of recurrence was moderate at 38% in long-term follow-up in that study, in which patient satisfaction was very high. In our study, 20% of patients had excellent, 33.33% had very good, 33.33% had good and only 13.33% had poor response.

Michel *et al.*, in 2001 reported the observations of five patients with ILVEN and five patients with linear verrucous epidermal naevus managed by superpulsed CO<sub>2</sub> laser which was effective in all cases but two.<sup>[16]</sup> Satisfactory cosmetic results were obtained; with side effects of slight hyperpigmentation, transitory desquamation and erythematous papules. There was no recurrence in 2 years follow-up. Three of our patients showed recurrence of lesions after 10 months of follow-up.

Verma *et al.* reported eight patients, two males and six females with epidermal (4) and sebaceous naevi (4) in whom the lesions were vaporized with the indigenously developed CO<sub>2</sub> laser.<sup>[17]</sup> All the patients responded to the treatment. Three patients each with epidermal and sebaceous naevi had 80%–90% improvement while one patient each with above disorders had 30% and 60% improvement, respectively. Transient hypopigmentation was seen in all the patients with no other significant side effects. Our study showed more of hyperpigmentation post-treatment.

## CONCLUSION

From the results of our study, we conclude that CO<sub>2</sub> laser treatment appears to be effective and safe in long-term with minimal discomfort and rapid recovery. However, as there is variability in the depths of epidermal naevi, the margin of safety remains very narrow with this treatment modality, as deeper laser ablation can result in scarring. Thus, larger studies over a longer period are required to delineate the exact parameters to achieve



maximum benefits and at the same time minimise the risk of unwanted scarring.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### REFERENCES

1. Sugarman JL. Epidermal nevus syndromes. *Semin Cutan Med Surg* 2007;26:221-30.
2. Brandling-Bennett HA, Morel KD. Epidermal nevi. *Pediatr Clin North Am* 2010;57:1177-98.
3. Fearfield LA, Bunker CB. Familial naevus sebaceous of Jadassohn. *Br J Dermatol* 1998;139:1119-20.
4. Happle R, König A. Familial naevus sebaceus may be explained by parandominant transmission. *Br J Dermatol* 1999;141:377.
5. Hafner C, Toll A, Real FX. HRAS mutation mosaicism causing urothelial cancer and epidermal nevus. *N Engl J Med* 2011;365:1940-2.
6. Hafner C, López-Knowles E, Luis NM, Toll A, Baselga E, Fernández-Casado A, *et al.* Oncogenic PIK3CA mutations occur in epidermal nevi and seborrheic keratoses with a characteristic mutation pattern. *Proc Natl Acad Sci U S A* 2007;104:13450-4.
7. Hafner C, van Oers JM, Vogt T, Landthaler M, Stoehr R, Blaszyk H, *et al.* Mosaicism of activating FGFR3 mutations in human skin causes epidermal nevi. *J Clin Invest* 2006;116:2201-7.
8. Odom RB, James WD, Berger TG. Sebaceous nevi and tumors. In: *Andrews' Diseases of the Skin*. 9<sup>th</sup> ed. Philadelphia, PA: WB Saunders; 2000. p. 845-6.
9. Hohenleutner U, Landthaler M. Laser therapy of verrucous epidermal naevi. *Clin Exp Dermatol* 1993;18:124-7.
10. Ashinoff R. Linear nevus sebaceous of Jadassohn treated with the carbon dioxide laser. *Pediatr Dermatol* 1993;10:189-91.
11. Ratz JL, Bailin PL, Wheeland RG, Roenigk RK. Carbon dioxide laser treatment of epidermal nevi. *J Dermatol Surg Oncol* 1986;12:567-70.
12. Barkham MC, White N, Brundler MA, Richard B, Moss C. Should naevus sebaceous be excised prophylactically? A clinical audit. *J Plast Reconstr Aesthet Surg* 2007;60:1269-70.
13. Alonso-Castro L, Boixeda P, Reig I, de Daniel-Rodríguez C, Fleta-Asín B, Jaén-Olasolo P. Carbon dioxide laser treatment of epidermal nevi: Response and long-term follow-up. *Actas Dermosifiliogr* 2012;103:910-8.
14. Hohenleutner U, Wlotzke U, Konz B, Landthaler M. Carbon dioxide laser therapy of a widespread epidermal nevus. *Lasers Surg Med* 1995;16:288-91.
15. Thual N, Chevallier JM, Vuillamie M, Tack B, Leroy D, Domp martin A. CO<sub>2</sub> laser therapy of verrucous epidermal nevus. *Ann Dermatol Venereol* 2006;133:131-8.
16. Michel JL, Has C, Has V. Resurfacing CO<sub>2</sub> laser treatment of linear verrucous epidermal nevus. *Eur J Dermatol* 2001;11:436-9.
17. Verma KK, Ovung EM. Epidermal and sebaceous nevi treated with carbon dioxide laser. *Indian J Dermatol Venereol Leprol* 2002;68:23-4.